

A Landscape Level of Integrated Valued Ecosystems Program and its Contribution to the I-70 Mountain Corridor Programmatic Environmental Impact Statement

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A Landscape Level of Integrated Valued Ecosystems Program and its Contribution to the I-70 Mountain Corridor Programmatic Environmental Impact Statement

1. Introduction

In 2004, Colorado Department of Transportation (CDOT) published a Draft Programmatic Environmental Impact Statement (PEIS) to address transportation issues in the I-70 Mountain Corridor. The Draft PEIS was prepared by J.F. Sato and Associates (JFSA) and contained considerable information on wildlife, their habitat, and the barrier effect that a major highway has on wildlife. Wildlife information in the Draft PEIS was compiled, in part, by the ALIVE Committee (A Landscape Level of Integrated Valued Ecosystems), a multi-agency committee of wildlife professionals.

In early 2007, the Southern Rockies Ecosystem Project (SREP), a private, non-profit organization working to protect and restore ecological integrity throughout the southern Rocky Mountains by connecting networks of land and networks of people, approached JFSA about background information on the ALIVE Committee. Specifically, SREP was interested in the process that the ALIVE Committee followed in preparing the wildlife information and mitigation measures for wildlife, especially for proposed wildlife crossing structures in the Corridor.

With the concurrence of CDOT, JFSA has prepared this document to respond to the SREP inquiry.

- Section 2 of this document presents the background and purpose of the ALIVE Committee and describes the political framework that led to the creation of the ALIVE Committee.
- Section 3 describes how the committee was formed under the auspices of CDOT and includes a review of the Committee's mission, meeting schedule, and the deliberative process that was used. Because the Committee was a multi-agency effort, the Memorandum of Understanding is presented in Appendix A.
- Section 4 presents general background discussions of wildlife issues and pressures that exist in the I-70 Corridor. The wildlife issues and pressures were prepared by JFSA for the Draft PEIS and were used by the ALIVE Committee to assist in their evaluation of potential impacts and formulation of mitigation measures.
- One of the major efforts of the ALIVE Committee was the identification of wildlife linkage interference zones (LIZ). Section 5 describes this effort and presents unpublished information from the ALIVE Committee meetings. Appendix B presents a summary of the ALIVE Committee meeting notes.
- Section 6 identifies the information from the ALIVE Committee that was actually published in the Draft PEIS, and Appendix C presents excerpts from the Draft PEIS.
- Section 7 presents the final ALIVE recommendations for wildlife mitigation in each LIZ along the I-70 Corridor.

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2. Background and Purpose of ALIVE

As part of a streamlining program, CDOT initiated the ALIVE program in response to strategic planning efforts by Federal Highway Administration (FHWA) as contained in Section 1309 of the Transportation Equity Act for the 21st Century (TEA-21) of 1998. Seven federal agencies, including the US Department of Transportation, signed a Memorandum of Understanding (MOU) endorsing the strategic planning effort. Under this national framework, the states formulated their own strategic action plans to implement TEA-21. CDOT prepared an action plan and a draft MOU for state resource agencies. In the MOU, the I-70 Mountain Corridor was included as a “pilot project” to test new ways of cooperatively addressing concerns and mitigation early in the planning process. The Draft PEIS for the I-70 Mountain Corridor emphasized (1) proactive agency coordination and public involvement programs and (2) a work plan that includes directions to develop scopes of work for each resource area. The scopes of work were developed in coordination with the respective agency representatives to achieve agreement or acceptance.

In 2000, CDOT started the environmental streamlining program for the I-70 PEIS related to wildlife conservation by contacting various state resource agencies and convening organizational meetings that led to the creation of the ALIVE Committee. The program was intended to streamline activities related to special status plant communities, species habitats, ecological processes, and the barrier effect of the Corridor for early coordination and up-front interagency agreement on priorities for the I-70 Corridor. The streamlining goals included not only enhancing the timeframe normally needed to secure interagency agreement but also optimizing expenditures for wildlife enhancement and mitigation toward the best application along the I-70 Corridor.

The primary issue affecting wildlife in the Corridor is the interference of I-70 with wildlife movement and animal-vehicle collisions (AVCs). Barriers to wildlife movement include structural, operational, and behavioral impediments to wildlife trying to cross I-70. The potential for increased structural barriers was analyzed in the PEIS based on horizontal (additional lanes) and vertical (walls, Jersey and Texas barriers, fencing), and operational (guideway systems, rail systems) components that would present various kinds of barriers to wildlife movement across the I-70 Corridor.

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3. The ALIVE Committee

Following an organizational meeting by CDOT Office of Environmental Services (OES) on March 7, 2000, and agency contacts, the first ALIVE Committee meeting was convened on February 9, 2001. CDOT and FHWA enlisted four other agencies—Colorado Division of Wildlife (CDOW), US Bureau of Land Management (BLM), US Forest Service (Forest Service), and US Fish and Wildlife Service (USFWS)—to participate in the program to address the barrier effect issues of the Corridor. The specific member agencies of the ALIVE Committee were:

- Arapaho-Roosevelt National Forests (ARNF)
- Colorado Department of Transportation
- Colorado Division of Wildlife
- Federal Highway Administration
- Bureau of Land Management
- US Fish and Wildlife Service
- White River National Forest (WRNF)

The ALIVE Committee was composed of wildlife professionals from agencies with jurisdictional concerns in the Corridor. The objective was to streamline agency activities for early coordination and up-front interagency agreement on priorities for the Corridor. Goals included not only to enhance the timeframe normally needed for interagency agreement but to optimize expenditures for wildlife enhancement and mitigation for the best application along the Corridor. Appendix A provides the MOU signed by the agencies.

The mission of the ALIVE Committee was stated as follows:

“It is the intent of the Parties to increase the permeability of the I-70 Corridor to terrestrial and aquatic species, including but not limited to deer, elk, the boreal toad, fish (for example, greenback cutthroat trout), and forest carnivores (for example, Canada lynx). This includes development of management strategies that will result in the long-term protection and restoration of wildlife linkage areas that intersect the I-70 Corridor, improve habitat connectivity, and preserve essential ecosystem components.”

To meet this intent, the following actions were undertaken:

- Designation of key wildlife habitat, including Canada lynx habitat
- Identification and characterization of LIZs
- Analysis of specific conflict areas for wildlife crossing the roadway within the LIZs
- Recommendations for mitigating conflicts through wildlife crossings and other techniques including fencing and land conservation strategies
- Evaluation of goals for the development of conservation measures such as the design of structures suitable for wildlife crossings, and protective land purchase to preserve habitat linkage for lynx and other wildlife species in the Corridor

Because the first meeting was attended by 28 persons, the large group agreed to form a subgroup of one or two persons from each agency who would be

responsible for coordinating the data gathering at each agency and working with the consultant (J.F. Sato & Associates) doing the geographic information system (GIS) mapping for the PEIS. The chronology of the 16 meetings was as follows:

- February 9, 2001
- March 15, 2001
- April 19, 2001
- May 23, 2001
- August 15, 2001
- September 20, 2001 (teleconference)
- October 1, 2001
- November 27, 2001
- March 6, 2002 (Workshop with SWEEP)
- July 30, 2002 (MOA Group)*
- August 27, 2002 (MOA Group)*
- September 30, 2002 (MOA Group)*
- October 28, 2002 (MOA Group)*
- November 20, 2002 (MOA Group)*
- January 14, 2003
- March 6, 2003

*Memorandum of Agreement

Discussions from the ALIVE Committee meetings were recorded as part of the administrative record for the PEIS. The meeting minutes comprise more than 250 pages of notes and transcripts. This record, including lists of attendees, was summarized on a meeting-by-meeting basis and is presented in Appendix B.

As a result of their efforts, the ALIVE Committee made significant contributions to the PEIS. A wide range of ecological data was collected and evaluated, including assessments of high-value conservation sites as well as impaired landscape components, all of which helped target effective landscape-level mitigation strategies. All data used were gathered in spatial formats using GIS-based analytical tools. This approach supports a long-term strategy for identifying direct, secondary, and cumulative effects of alternative actions. The Committee also recommended site-specific mitigation measures that would enhance the permeability of the I-70 Corridor to wildlife crossings.

4. Wildlife Issues and Pressures in the I-70 Corridor

The Corridor and surrounding area contain various man-made features that influence the structure and function of the natural environment. The I-70 Draft PEIS identified interference with wildlife movement due to the barrier effects created by I-70 as one of the most serious issues affecting wildlife in the Corridor. Highways, roads, towns, single-home sites, and recreational developments along the Corridor influence which areas are available for wildlife. Current and historic human activities within the Corridor have been instrumental in creating the current distribution of habitats and wildlife species in the Corridor. Important man-made factors include fire regime, mining, agricultural development, livestock grazing, land development, road construction, and recreation development. Secondary or indirect impacts from these activities include non-native plant invasions, degraded water quality, and human intrusion into wildlife habitats. Although mining, logging, and grazing historically had the greatest influence, human settlements currently have the greatest indirect effect on the natural systems in the Corridor. Because development tends to be concentrated in the valley bottoms, some of the most notable effects are loss of high-quality riparian, wetland, and floodplain habitats and habitat fragmentation that includes reduced access to these habitats.

Figure 1 illustrates the relationships of key wildlife habitats, lynx linkage areas, and LIZs. Lynx linkage areas are areas with suitable lynx habitat on both sides of the Corridor and where lynx are thought to cross the Corridor. LIZs are areas with suitable habitat for various species located on both sides of the Corridor and where those species have traditionally traveled. This diagrammatic illustration is provided for comparison of key biological features throughout the Corridor.

4.1 Existing Highway-Related Impacts

The footprint of the existing highway occupies relatively little habitat, compared to the amount available in the surrounding area. However, because I-70 is often located along valley bottoms throughout the Corridor, it impinges upon some of the less common and more valuable habitats in the area of potential effect. In general, valley bottoms contain watercourses that support riparian vegetation and wetlands. These habitat types are important to a wide variety of wildlife in Colorado and are easily compromised by disturbance.

Fragmentation of large animal ranges/habitats and movement corridors caused by I-70 is an even more important issue than habitat loss. Identification of LIZs was used to estimate the amount of movement interference caused by the existing highway in the Corridor. LIZs are locations along the Corridor where evidence suggests that the existing highway's barrier effect impedes traditional wildlife movement patterns. LIZs were identified based largely on expert opinion and the location of existing barriers to at-grade crossings, including guardrails and fencing. AVC data were also considered. A high rate of AVCs in an area was assumed to indicate that that portion of the highway intersected an important animal movement corridor. Additional information about historic movement patterns of mule deer, elk, bighorn sheep, and, when data were available, carnivores, was also considered.

The Colorado State Patrol reported a total of 923 AVCs in the Corridor for the 1990 to 1999 period. These data are considered an incomplete picture of AVCs along the Corridor because only animals large enough to damage a vehicle when struck were included, and only a small number of those AVCs are reported. Based on interviews with Department of Transportation and wildlife agency personnel nationwide, Romin and Bissonette (1996) estimated 16 to 50 percent of all AVCs are reported. A study conducted in Nevada compared observed roadkilled deer to reported AVCs along a stretch of highway and estimated that only 20 percent of AVCs were reported (Messmer et al. 2000).

Forman and Alexander (1998) coined the term “road effect zone” to encompass a wide range of impacts on wildlife including noise and traffic disturbances, as well as input of contaminants into habitats from road maintenance and operations. The width of the road effect zone varies with species and terrain (Singleton et al. 2002). Rost and Bailey (1979) indicated effects occurred approximately 600 feet for mule deer and elk in forest habitats but could extend up to 1,200 feet in shrub habitats. Forman and Deblinger (2000) addressed moose, deer, amphibians, forest birds, and grassland birds and calculated an average road effect zone of almost 2,000 feet for their Massachusetts study. Influences of highway activity and noise may be greater for the more sensitive species such as lynx or wolverine and may limit their movements through areas adjacent to the road (USDA 2002a,b). Winter maintenance material used to improve traction and/or melt ice from roadways is known to affect downstream (downgradient) habitats. Sand is especially evident at the higher elevations of the Corridor, such as on Vail Pass and approaches to the Eisenhower-Johnson Memorial Tunnels (EJMT) where application is more frequent than at lower elevations. CDOT is currently studying the means to control winter maintenance material and reduce the amount that escapes the roadway.

4.2 Development Influence

In addition to I-70, human population centers, increasing development, and human intrusion act as barriers to wildlife that historically crossed the Corridor in their migration or daily movements. Animals cross such barriers to access key habitats that supply forage, prey, cover, and water; to repopulate additional areas; and to fulfill breeding and young-rearing requirements. Transportation corridors and the communities that have developed have been a prominent cause of habitat fragmentation in the Colorado mountains in general (USDA 2002b). Mountain valleys that contain important habitats and serve as wildlife migration and movement pathways are often subject to development.

4.2.1 Wildlife and Threatened, Endangered, and Special Status (TES) Species Issues

The most important wildlife cumulative effects issues associated with the I-70 project include planned development in the Corridor, possible induced growth associated with the project, fragmentation of habitat, and barrier effects on wildlife movement.

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4.2.2 Geographic Scope

Figure 2, Cumulative Impacts Analysis Study Area, illustrates the geographic scope of the analysis. The study area encompasses portions of the Eagle River, Blue River, and Clear Creek watersheds adjacent to I-70 that are within the immediate development influence zone, based on a compilation of future land use zoning. In addition, cumulative effects on the regional economy and employment from the project are addressed within a nine-county region, including Garfield, Eagle, Pitkin, Summit, Lake, Park, Grand, Gilpin, and Clear Creek counties. The Colorado River watershed is not included in the cumulative impacts study area because project impacts would be extremely limited or nonexistent.

4.2.3 Cumulative Effects Baseline (Past and Present)

Many factors have influenced natural ecosystems within the Corridor, including transportation, community development, mineral exploration, grazing, increased fire frequency, and, conversely, fire suppression. These factors have contributed to the creation of barrier effects on wildlife movement, habitat fragmentation, increased impervious surface, modified vegetation composition and wildlife habitats, erosion, and the increase and spread of weeds, including those that are considered noxious.

Human development has had, perhaps, the greatest effect on natural systems throughout the Corridor (USFS 2002b). Relatively large areas of vegetation have been removed or altered in conjunction with the larger concentrations of developments. One of the most notable effects of such development along the Corridor over approximately the last 120 years is habitat fragmentation. Habitat fragmentation occurs when large patches of habitat are divided into smaller patches, and the connections between these smaller patches are compromised or lost. A timber sale area or an isolated area of land use conversion also serves to disrupt connectivity and is considered a habitat “perforation.” Factors that reduce connectivity between habitats include community development, associated road systems, and fencing. If individual animals cannot move freely between habitat patches, entire populations may become separated. As a consequence, each smaller population becomes more susceptible to genetic degradation and extirpation from a single catastrophic event, such as a disease outbreak (Jackson 1999). Recent resort development, including ski areas and golf courses, has also reduced the amount of habitat available in some parts of the Corridor. Human intrusion into adjacent habitats from these areas further reduces the amount of habitat available to federally listed species. Another effect of development is the introduction of weed species that often gain a foothold when land is cleared for construction.

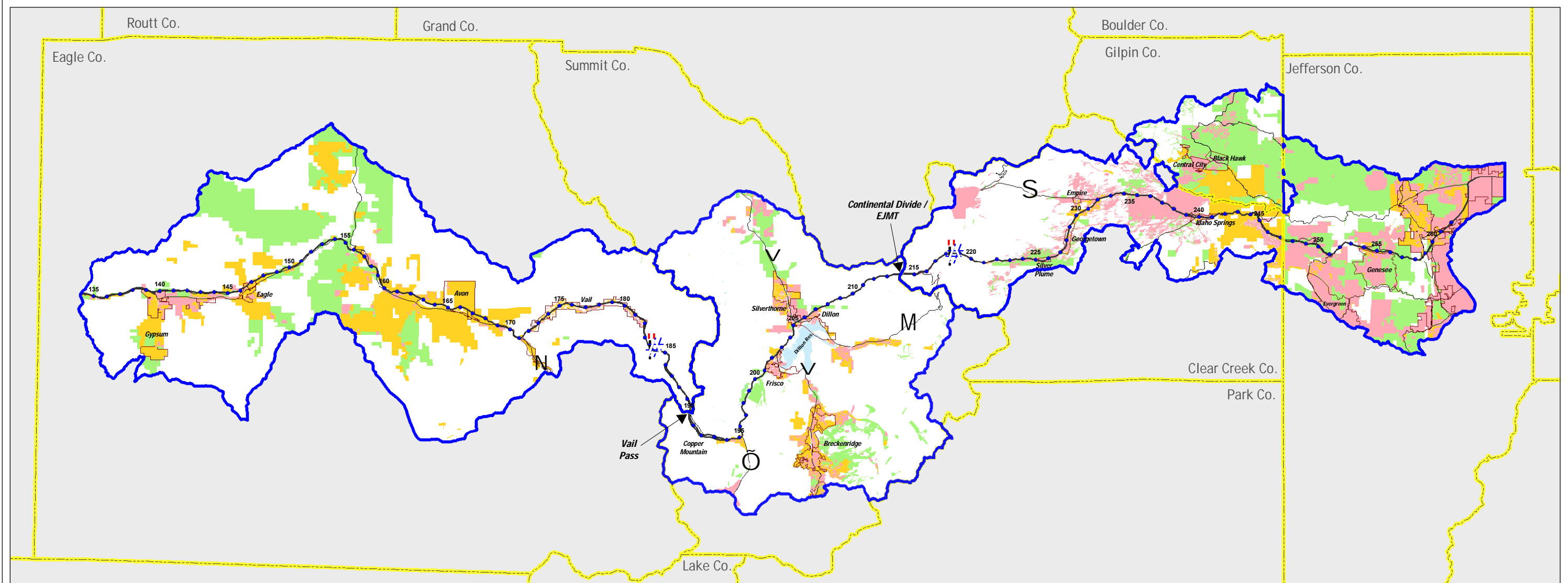
I-70 has become a barrier to wildlife movement, especially where the interstate interferes with linkage areas. Effects on wildlife and plants are difficult to quantify, although the construction of I-70, along with other roads in the vicinity, has caused considerable habitat fragmentation (USFS 2002b). The road effect zone, as defined by Forman and Alexander (1998), varies depending on adjacent terrain and habitats, with noise extending farther into more open habitats than forest habitats. Noise from traffic also affects the use of adjacent habitat to varying degrees by different species, depending on their sensitivity. Other road effects along I-70 include the change of both surface and groundwater flows that are bisected and often diverted beneath I-70 in culverts. The degradation of roadside habitats from traction sand and chemical deicers is another road effect. Finally, the ability of animals to physically cross the road (“crossability”) is another important element of the road effect. Small animals cannot climb over Jersey barriers or are relatively slow-moving, and large animals are subject to AVCs.

Referring to Figure 2, it is clear that the planned urban and rural development will increase the amount of developed areas in the three watersheds by a tremendous amount. Currently, 4 percent of the Eagle River watershed (HUC 6) is developed, but plans are that by 2025, the developed area will be 29 percent. The Blue River watershed is currently 5 percent developed and is projected to be 18 percent developed in 2025. Development has been affecting the Clear Creek watershed for several years, and it is currently 13 percent developed. By 2025, development in the Clear Creek watershed is projected to be 68 percent.

AVCs were documented from 1988 to 1998 along I-70. The average rate of AVCs was 0.6 collisions per mile per year (collisions/mile/year), but AVCs at different locations ranged from 0.0 to 2.4. The data indicated that LIZs with AVCs of 1.4 or less could be considered “normal” and AVCs greater than 1.4 could be considered a trouble spot where animals were frequently trying to cross I-70. Of the 15 LIZs along the Corridor, the greatest rate of AVCs (2.4) was in LIZ 13, Mount Vernon Canyon. The second highest AVC (1.4) was reported for LIZ 1 near Dotsero. These two LIZs are in the foothills or low-elevation montane life zones. All other LIZs had AVCs below 1.2, and two LIZs had zero AVCs.

4.2.3.1 Growth Effects

Corridor populations in mining areas experienced “boom and bust” cycles from the 1850s to the 1890s. Access provided by the initial construction of I-70 spurred Corridor population growth from the late 1950s to the current time. Corridor counties (encompassing a nine-county area) are projected to grow by 100 percent from 2000 to 2025. Past trends in Corridor population growth and I-70 traffic are evident, based on population and Annual Average Daily Traffic (AADT) data since 1985. Based on past growth patterns (past 15 years), the population in Eagle County has grown at the greatest rate in relation to I-70 traffic, and this relationship is expected to continue into the future. Summit County population growth can also be related to I-70 traffic growth but is not as sensitive to such growth as Eagle County. Based on past growth patterns of population and traffic, Garfield County was not found to be particularly sensitive or susceptible to possible induced growth from project alternatives.



EAGLE RIVER WATERSHED Study Area

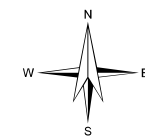
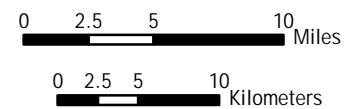
BLUE RIVER WATERSHED Study Area

CLEAR CREEK WATERSHED Study Area

Past, Present, and Future Development Activities in Corridor

RESOURCE DESCRIPTION	Geographic Areas (Aggregated HUC 6 Watersheds)	Acres	COUNTY AND TOWN DEVELOPMENT				FOREST MANAGEMENT, RECREATION, OPEN SPACE		ROADS AND HIGHWAYS			
			Historic and Existing (Before 1-70 and 2000 Eras)	Planned Urban Development (Zoning and FLUM*)	Planned Rural Development (Zoning and FLUM*)	Total	Special Management Areas (Wilderness, Nonmotorized, Open Space)	Active Recreation Management Areas (Developed Recreation, Motorized, Ski Areas)	Roads (Not Including I-70)		Existing I-70 (Footprint and Roadside Cut and Fills)	
									acres	acres	acres	acres
			percent	percent	percent	percent	percent	percent	percent	percent	percent	percent
SELECTED HUC 6 WATERSHED AREAS Corridor (includes existing and future development)	Eagle River	342,820	13,167 4%	39,377 11%	47,703 14%	100,247 29%	149,932 44%	91,507 27%	900 4%	13,642 9%	56 0.5%	1,653 1%
	Blue River	222,420	10,476 5%	13,261 6%	16,789 8%	40,526 18%	140,796 63%	45,830 21%	600 4%	9,094 23%	24 0.5%	1,039 2%
	Clear Creek	287,370	37,597 13%	59,915 21%	68,856 24%	196,713 68%	50,277 17%	67,097 23%	1,490 8%	23,500 54%	46 0.6%	1,589 4%
	Total	852,610	61,240 7%	99,965 12%	113,558 13%	337,486 40%	336,178 39%	196,249 23%	2,990 5%	46,236 54%	126 0.5%	4,280 5%

- Existing Development (includes mining - Clear Creek Co.)
- Planned Urban Development
- Planned Rural Development
- Forest Management / Open Spaces
- Watershed Study Area
- Surrounding Counties



SCALE - 1:468,000 or 1" = 39,000'

Cumulative Impacts Analysis Study Area Figure 2

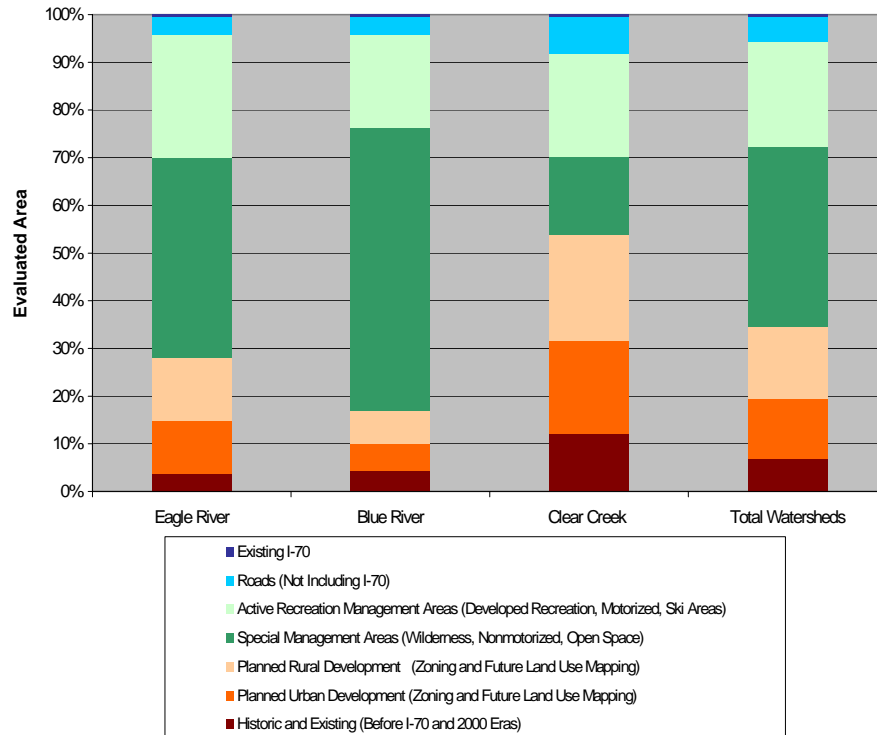
I-70 has influenced land use patterns in the Corridor since it was built. A relationship among growth in I-70 traffic, land use change, and population increases in the Corridor region over the past 15 years suggests that changes in future travel demand due to increased capacity of I-70 would be growth-inducing to the region. Corridor land use before I-70 was constructed was predominantly associated with tourism, mining, and agriculture. Changes in future travel demand would continue to affect land use in the region. Susceptibility to changes in population due to induced or suppressed travel demand would be limited to Eagle and Summit counties. Clear Creek County is not expected to experience growth-inducing effects from project alternatives (as discussed in Chapter 3, Section 3.9 of the Draft PEIS).

4.2.3.2 Estimate of Land Use Growth in Watersheds

Chart 1 provides the percentage of existing and planned land use within the cumulative study area. A primary area of interest for cumulative impacts is the high degree of planned urban and rural developments in relation to existing development and land use as a whole. “Past and present” actions are represented by historic and existing development, while “reasonably foreseeable future” actions are represented by planned development.

The total area of planned urban and rural development in the combined watershed area (approximately 246,000 acres) is four times the existing developed area (61,240 acres). Planned development is expected to increase the total developed area within the watersheds from approximately 7 percent to 35 percent (approximately 307,000 acres). The remaining watershed area is in forest management, recreation, and open space uses. Existing I-70 is estimated to represent 0.5 percent of the evaluated land area, while other roads and highways represent 5 percent of the area. The area reported for roads and highways overlaps with the developed and forest management land area. Chart 1 also shows the relative percentages of land use types by watershed and for the total three-watershed area.

Chart 1. Past, Present, and Reasonably Foreseeable Future Actions in Watershed Study Area



4.2.3.3 Cumulative Effects on Threatened, Endangered, and Sensitive Species

Threatened, endangered, and sensitive species in the Corridor have been affected by increased human intrusion from land development into their habitats and their movement corridors, as well as by habitat losses. Most of the habitat for these species occurs on National Forest System and BLM lands, which afford management and protection from direct habitat losses. However, increased use of these areas for recreation has increased the potential for human disturbance to wildlife and vegetation. I-70 currently and in the future would contribute the following effects for different classes of species:

1. For mobile (wide-ranging) species, the highway is a barrier with the potential for AVCs and direct mortality. Lynx, for example, have large home ranges that are likely to be affected by future land development. Lynx linkage areas have been identified on National Forest System and BLM lands along the Corridor and include the following areas:
 - Dowd Canyon connects north and south habitats. Residential development on the north along the Eagle River and to the south toward Minturn is expected to affect lynx crossing in this area.
 - West Vail Pass is an ideal linkage between habitats and might be affected by increased winter recreation use.
 - Officers Gulch connects habitat between the Tenmile Mountain Range, the Leadville area, and the Eagles Nest Wilderness Area. Continued development of the Breckenridge area will affect this linkage, which is the principal lynx habitat connection between Copper Mountain and Frisco.

- Laskey Gulch is part of a large linkage area that connects Loveland Pass, Peru Creek, and Jones Gulch. Continued development in parts of this linkage (such as in Keystone Resort, Jones Gulch, Breckenridge-Frisco area) will affect wildlife movements.
 - Herman Gulch connects lynx habitat north and south of the Clear Creek drainage. Increased recreation that occurs from increased access and population centers outside the area is likely to affect the lynx (and other sensitive species).
2. For localized ground-dwelling species, the highway is a barrier with the potential for AVCs, direct mortality, and habitat removal that would affect many individuals, especially small mammals and amphibians. Possible cumulative effects would include:
- Encroachment and disturbance on wildlife habitat as a result of development activities, recreational use, and roadways
 - Barrier effects and movement interruption (between traditional habitat areas) caused by rural development and roadways
 - Fragmentation, decreased connectivity, and “habitat isolation” of wildlife habitat caused by rural development and roadways
 - Displacement of sensitive wildlife populations
 - Direct mortality

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5. Linkage Interference Zones

LIZs are areas along the Corridor where the wildlife evidence suggests that the I-70 barrier-effect impedes traditional wildlife movement through historic wildlife corridors. These corridors include migration routes and pathways used by a species to access required parts of their habitat on a more frequent basis than seasonally. In all instances, these movement pathways connect two important components of a species' habitat needed to complete their lifecycle. When I-70 is in between those two components, the Corridor interferes with movement in the habitat. The specific information used to define LIZs that was provided by the agencies is discussed in the following paragraphs.

Numerous datasets were readily available for the analyses, including data compiled by the Colorado Natural Heritage Program (CNHP), Forest Service, BLM, CDOW, CDOT, and local counties and municipalities. Data sets of interest for the ALIVE program included both natural and manmade components of the landscape.

The Forest Service maintains vegetation datasets derived from 1:12,000 to 1:24,000 scale aerial photography that served as a primary base for habitat analyses for species inhabiting the respective forests. On a regional scale, the Geographic Analysis Program (GAP) data, a satellite-based mapping and classification of vegetation, was used to supplement Forest Service vegetation data, which did not include an inventory of non-forest lands. GAP data have a resolution ranging from 25 meters to approximately 1 square kilometer and was, therefore, used only to supplement the Forest Service vegetation datasets due to the low accuracy of the data. Forest Service watershed boundaries for the state were used for habitat analyses.

The Wildlife Resource Information System (WRIS), operated through CNHP, maintains data for a variety of species and served as the primary source of species distribution data at the watershed and regional level. The Arapaho and Roosevelt, White River, and Pike/San Isabel National Forests provided additional digital datasets of species distribution information, including Lynx Analysis Unit (LAU) datasets for each respective forest district. Maps were produced to show the distribution and shared habitats of key species, including but not limited to Canada lynx, elk, mule deer, black bear, mountain lion, and wolverine. Watersheds supporting boreal toad populations were identified and considered in the analysis process.

For inventory and analysis on a local scale, digital, high-resolution 0.5-meter color infrared aerial photography from 2000, covering approximately 0.5 miles on each side of I-70, was used and served as a base for mapping purposes. Through data sharing agreements, additional high-resolution aerial photography was used from Clear Creek and Eagle counties. Primary data collection for the Corridor included a terrestrial photographic and spatial inventory of all bridges, culverts, drainage structures, guardrails, and median barriers. Existing impedances, including walls and cut-and-fill slopes, were included in the analysis. CDOW District Wildlife Managers (DWMs) provided input on species activity through the Corridor and supplemented WRIS data with detailed knowledge of specific locations, including site-specific AVC data.

Through data agreements with local counties, GIS-based land use parcel and zoning data were obtained and used to identify existing and future potential

wildlife habitat conflict areas. AVC data in the form of “hot spots” were also used when available on the wildlife maps. Hot spots indicate areas where animals are more likely to attempt to cross I-70 and are areas that depart significantly from the average number of AVCs/year/mile for every 1,000 vehicles for the whole study area (CDOT 2001). Ultimately, this led to the development of LIZ maps displaying the host of impedances to wildlife through the zones, including median and guardrail barriers and land developments. All the LIZs are shown in Figure 3, and the 15 individual LIZ maps are presented as part of Appendix C. Existing crossing structures were also inventoried and displayed on the maps with terrestrial photos to display the relative dimensions and setting.

5.1 Habitat Ranking and Analysis

A key focus of the ALIVE program was the identification of natural landscape features important to specific ecological functions and impaired landscape features not functioning properly. A wide range of ecosystem components including, but not limited to, contiguous blocks of habitat, wildlife linkages, migration routes, vegetation, slope, and summer and winter ranges and concentrations were studied. Obvious gaps between blocks of habitat, fragmented ranges of elk herds or deer herds, barriers to animal movement, blocked flows of streams and wetlands, and habitats threatened by development were identified and analyzed. Areas of development and unsuitable habitat were, in turn, identified as a part of the process. The findings of this analysis represent a component of an effective mitigation plan for the entire Corridor.

A species-specific example of the habitat analysis is provided by Canada lynx. CDOT developed a statewide least-cost model for impedance for the Canada lynx. The model incorporated multiple factors affecting movement, including vegetation, slope, developed areas, and physical barriers. Forest Service LAU and linkage areas were incorporated to identify critical areas of habitat and probable lynx movement. On a local scale, these patterns were looked at more closely, taking into account game trails, roadkill patterns, and DWM’s knowledge. Through this process, key watersheds were identified where lynx were most likely to cross I-70; other non-suitable habitats were identified as a result. This ultimately resulted in the identification of areas where crossing structures were needed.

For all wildlife species, zones along I-70 were identified based on the present and past utilization as a movement corridor, their adjacencies to suitable habitat, and the potential improvement value. Distinct LIZs were developed. The zones were ranked based on their potential and existing value, and mitigation strategies were developed uniquely for each zone.

CDOW identified severe winter ranges, winter concentration areas, and lambing and calving areas for large game animals. In combination with the WRIS mapping developed by CNHP, CDOW identified key habitat areas along the Corridor including:

- Elk severe winter range, winter concentrations, and calving areas (Figure 4)
- Mule deer severe winter range and winter concentrations (Figure 5)
- Bighorn sheep summer range, winter range, winter concentrations, and lambing areas (Figure 6)
- Mule deer fawning areas, which are too scattered to be mapped

- Black bear summer/fall concentrations and black bear and mountain lion human conflict areas (Figure 7)

Because terrain features also were key to habitat value and important in defining key wildlife habitat, areas with steep slopes were mapped separately. The Forest Service provided the areas of forested habitats and characterized the different kinds of forests according to their species richness. Vegetation types (riparian and aspen forests) of the Corridor with the highest potential to be used for nest sites were used to measure the extent that songbirds could be affected by the alternatives.

The Forest Service designates certain species as management indicator species and monitors their populations to get an indication of the overall health of ecosystems. The management indicator species habitat also was mapped. Threatened, endangered, and special status species habitat also was mapped for both ARNF and WRNF, and for Clear Creek, Summit, Eagle, and Garfield counties. Noxious weeds and threatened and endangered plants were mapped to show whether and where they occurred in the Corridor. Other mapping in the Corridor included wetlands, riparian areas, streams, and standing water bodies.

Various members of the ALIVE Committee also reviewed the literature for wildlife crossing structures and control methods. The literature review contributed to the development of mitigation recommendations. Selected articles from different web pages are presented in the bibliography.

After evaluating the kinds of data listed above and overlaying those data on the Corridor map, it was possible to identify areas along the Corridor where wildlife had a high potential to occur. Comments by the wildlife professionals on wildlife movement patterns in and across the Corridor were among the final elements that allowed the definition of LIZs. The wildlife LIZs are shown in relation to the entire Corridor in Figure 3. Each individual LIZ is illustrated in large format in Appendix C. Table 1 presents the data layers that were used to map each LIZ.

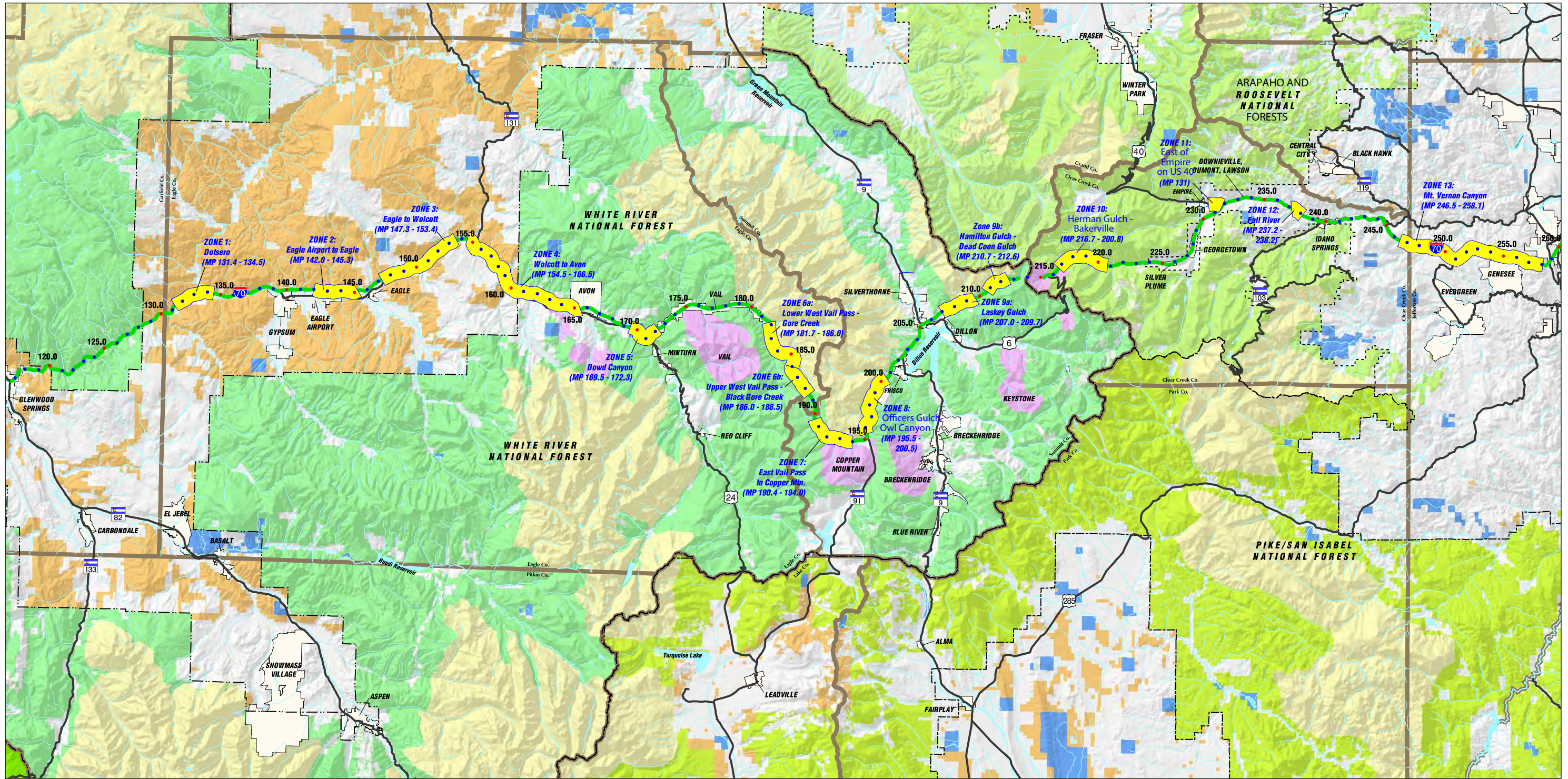
Table 1. Data Layers in Each LIZ Map

LIZ No.	1	2	3	4	5	6a	6b	7	8	9a	9b	10	11	12	13
Layers															
Parcels	X	X	X	X	X	X	X	X	X	X					X
CDOT Fencing	X	X	X		X	X	X								
Shoulder Barriers			X	X	X	X	X	X	X	X	X	X	X	X	X
Median Barriers			X	X	X	X	X	X	X	X	X	X	X	X	X
Stream Names	X	X	X			X	X	X	X		X				
Notes					X	X		X			X			X	
Irrigation Ditches		X													
Bridges, Culverts					X	X	X	X	X	X	X	X	X	X	X
CDOW Leases					X										

After data acquisition and analyses were complete, specific LIZs were identified and described. Final adjustments were made to the LIZ descriptions as late as November 2004. Table 2 identifies the LIZs by name and shows how the LIZs were identified over time. Some of the LIZs were defined early in the process, while others were defined much later.

Table 2. Evolution of Linkage Interference Zones During the Course of the ALIVE Meetings

LIZ No.	October 2002	March 2003	March 2004 and Draft PEIS
1	Dotsero, mp 131.4 to mp 134.5	Dotsero	Dotsero
2	Eagle Airport to Eagle, mp 142.0 to mp 145.3	Eagle Airport to Eagle	Eagle Airport to the Town of Eagle
3	Eagle to Wolcott, mp 147.3 to mp 153.6	Eagle to Wolcott	Eagle to Wolcott
4	Wolcott to Avon, mp 154.5 to mp 166.5	Wolcott to Avon, mp 154.5 to mp 166.5	Wolcott to Avon, mp 154.5 to mp 165.5 (mapped)
5	Dowd Canyon, mp 169.5 to mp 172.3	Dowd Canyon	Dowd Canyon
6	West Vail Pass, mp 182.5 to mp 188.5	6A – West Vail Pass (lower), mp 182.5 to mp 186	West Vail Pass (lower), mp 181.7 to mp 186.0 (as mapped)
		6B – West Vail Pass (upper), mp 186.0 to mp 188.5	West Vail Pass (upper), mp 186.0 to mp 188.5
7	East Vail Pass, mp 190.4 to mp 194.0	East Vail Pass	East Vail Pass to Copper Mountain
8	Owl Canyon to Officers Gulch, mp 195.5 to mp 200.9	Officers Gulch/Owl Canyon mp 195.5 to mp 200.9	Officers Gulch/Owl Canyon
9	Laskey Gulch, mp 207.0 to mp 209.7	Laskey Gulch	9A – Laskey Gulch, mp 207.0 to mp 209.7
			9B – Hamilton Gulch to Dead Coon Gulch, mp 210.7 to mp 212.6
10	Empire Junction (US 40) mp 231.2 to mp 231.8	Herman Gulch/Bakerville, mp 218.0 to mp 221.0	Herman Gulch/Bakerville, mp 216.7 to mp 220.8 (as mapped)
11	Fall River, mp 237.2 to mp 238.2	Empire Junction	East of Empire on US 40, ~mp 231.9
12	Mount Vernon Canyon, mp 246.5 to mp 258.1	Fall River, mp 237.2 to mp 238.2	Fall River
13		Mount Vernon Canyon, mp 246.5 to mp 258.1	Mount Vernon Canyon



General Features

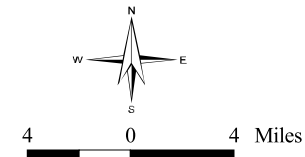
- I-70 Mileposts
- I-70
- State & Federal Highways
- White River NF
- Arapaho and Roosevelt NF
- Pike / San Isabel NF
- Rivers & Streams
- Lakes & Water Bodies
- County Boundaries
- Cities & Towns

Jurisdiction

- Arapaho and Roosevelt NF
- White River NF
- Bureau of Land Management
- Pike/San Isabel NF
- NF Wilderness

Wildlife Linkage Interference Zones

- State of Colorado
- Ski Areas
- Private Lands
- Wildlife Linkage Interference Zones



SCALE - 1:471,000 or 1" = 39,250'

I-70 Mountain Corridor PEIS
 Wildlife Linkage Interference Zones
Figure 3